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ABSTRACT

This is the fourth program in the Science Safari series produced by the Fairfax Network of the Fairfax County (Virginia) Public Schools. It focuses on large animals, their life, advantages and disadvantages of their size, and the adaptations that allow them to survive in their environments. The large animals highlighted include the Komodo dragon, the gorilla, the giraffe, the ostrich, the tarantula, the giant panda, and the elephant. The work of the National Zoo in ensuring the survival of species that are on the brink of extinction is also highlighted. This document includes background information and activities. (JRH)

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Land of the Giants

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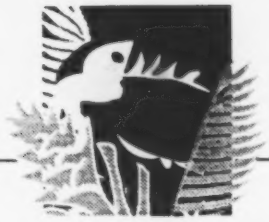

"Land of the Giants"

is the fourth program in the
Science Safari series, a production of
the Fairfax Network of the
Fairfax County Public Schools

in cooperation with:

Smithsonian Institution
National Zoological Park
NOAHS Center
Conservation and Research Center
(Front Royal, VA)

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The last "Science Safari" focuses on large animals in our show entitled "Land of the Giants." What is life like for large animals? What are the advantages and disadvantages of being an animal of size? The experts at the National Zoo will share their knowledge with us about large animals from different species. We will meet the Komodo dragon, the gorilla, the giraffe, the ostrich, the tarantula and the giant panda, and will revisit our elephant friends that we first met in our show about herd animals as well as several other animals who are considered large. It is hoped that you and your students will capture some of the majesty of these sizable creatures. Another area we will be looking at is how zookeepers work with large animals every day. I also know that you will once again be impressed by the work being done at the National Zoo to ensure the survival of species that are on the brink of extinction. My thanks to all of the dedicated scientists and zookeepers who have made "Science Safari" possible.

I want to thank you and your students for joining me on "Science Safari." I hope you have had fun and learned as much through viewing the show as I have by hosting it. I wish you the best of luck as you continue to explore the animal world with your students.

Don Petersen
Host

INTRODUCTION

This curriculum guide focuses on the giants of the animal kingdom and the adaptations that allow them to survive in their environments. If you've browsed the table of contents, you can guess that "giants" has a relative meaning here. Elephants, the largest land animals, are certainly giants. Similarly, tarantulas, as the largest members of the spider family, can also be called giants.

Successful adaptations enable a species to become better suited to conditions in the environment, fitting into it like a piece in a puzzle. The place where that animal's "puzzle piece" fits is called its ecological niche. If two or more species compete for a niche, one may eventually adapt to it and out–compete the others in finding food, establishing territory, and successfully reproducing. If conditions in an environment change quickly or drastically (or both), a species may not be able to adapt to the new set of conditions and may not survive.

With that in mind, here are some questions for students to answer as you lead them through this guide. What is significant about the "ecological niche" of large animals? Are there special needs or adaptations that set them apart from smaller creatures? For example, is an elephant's large size a successful adaptation? Could a lizard the size of a Komodo dragon have flourished anywhere in the world, or just on an island with no mammalian predators? What special skills does a huge arachnid like the tarantula have that make it such a successful predator? Where does the evolutionary history of a large animal such as the giant panda lie? Is it a raccoon, a bear, or something else entirely?

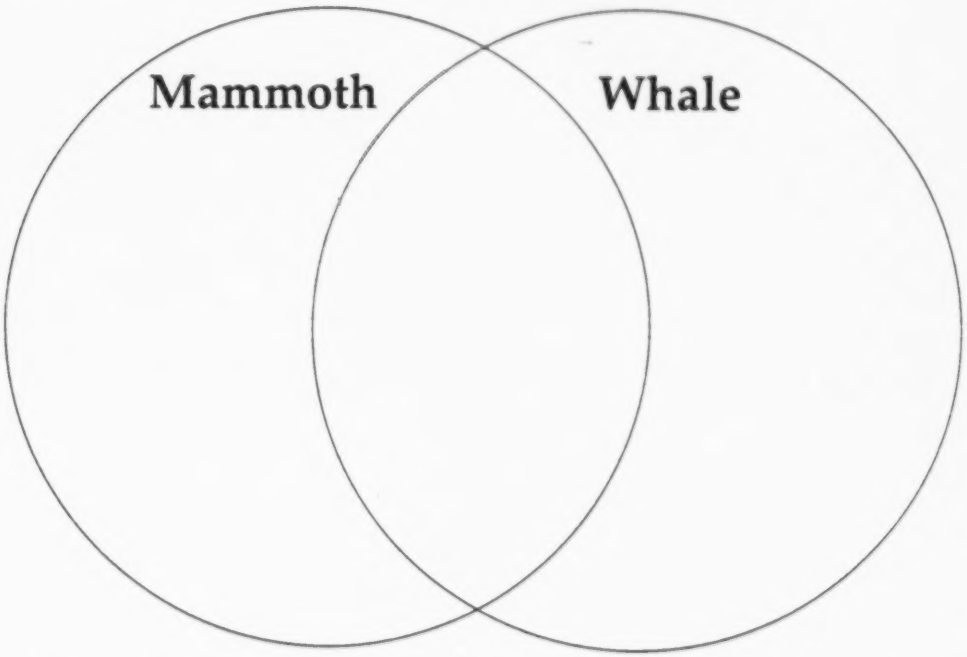
The key to all of these questions is in each animal's adaptations. Today researchers estimate that of all the species that ever lived on the Earth, over 99.9 percent are now extinct. What factors cause a specific species to survive and flourish while another succumbs to extinction? Why might "giants" be more susceptible to extinction than their smaller counterparts?

This guide poses questions within this context for students to ponder. We hope you and your students enjoy this look at giants of the animal kingdom and their unique adaptations. Please let us know if you have any comments on the content or format of this guide. You can send us an e–mail message at NOAHSCentr@aol.com. Thanks and enjoy!

PREVIEWING ACTIVITIES

1. Ask students to brainstorm, either in small groups or as a whole class, a list of animals that they think of as large animals. Direct students to discuss what size they consider an animal must be in order to be thought of as a giant. Students may select, individually or in groups, to research one of the animals from the student-generated list.

2. Direct students to conduct research on the mammoth and the whale. Then ask them to compare and contrast the two animals using a Venn diagram.



3. Ask students to select an animal and to create a trivia book or game about it. Trivia facts might include life span, size, different species, animal's behavior, habitat, what the animal looks like, eating habits, locomotion, communication, how it protects itself from enemies, animal's intelligence, its life as an infant, its life cycle.

4. Using the book "Dinosaur for a Day" by Jim Murphy (Scholastic ISBN 0-590-42866-7) as a model, instruct students to select a large animal and to write what a typical day would be like for the selected animal.

GIANT WORDS

abdomen	the last part of the body behind the thorax in spiders
adaptation	a change that occurs in a species over time that may allow it to survive more successfully in its environment
arachnids	a member of a group of animals having four pairs of jointed legs; includes spiders, scorpions, ticks, and mites
bamboo	a hard-walled stem plant with ringed joints; this plant makes up 99 percent of the great panda's diet
carapace	a hard outer covering that some animals, including spiders, have over some parts of their bodies
chromosome	located within the nucleus of a cell, it contains compact units of DNA
cephalothorax	the area of a spider's body that includes its head and thorax
DNA	deoxyribonucleic acid; a substance found in the chromosomes of every cell; DNA is organized into genes, which form the genetic code (or "blueprint" of life); individuals receive half of their DNA from their mothers and half from their fathers
ecological niche	the relationship, or "place," an animal or plant holds in its environment in relation to other plants, animals, and natural processes
neurotoxins	poisons in a tarantula's venom that attack the nervous system of its prey and paralyze the prey; usually not deadly to humans

PREVIEWING ACTIVITIES

5. The book "Little Giants" by Seymour Simon (William Morrow and Company ISBN 0–688–01727–4) is an excellent springboard for discussion and research on animals that are the largest of what are considered small animals.

6. Divide the class into teams. Ask each team to investigate the size (including height and weight) of several large animals as well as some dinosaurs. Send them out to the blacktop or field to create a life–size rendering of their chosen animal.

7. What's a "duck?" A "duck" is a building designed to look like either an animal or an inanimate object. Direct students to research the history of "ducks" and then design one of their own in miniature using construction paper. ("Lucy the Elephant" in New Jersey is one of the better known "ducks.")

8. Why are large animals important? What role do they play in the environment? What would happen if these animals no longer existed? These questions may lead into an interesting discussion and possible debate topic.

GIANT WORDS

pedipalps	a pair of appendages located near a spider's mouth and used as sensory organs; pedipalps are not real legs
spinnerets	the area of the body of a spider used to weave minute silk threads into a single strand of webbing
stridulate	the act of producing a high–pitched grating sound by rubbing parts of the body together; a tarantula stridulates by rubbing stiff bristles against its body
thermoregulation	maintaining a constant body temperature no matter what the environmental temperature; Komodo dragons, to accomplish this, bask in the sun to warm up and rest in the shade to cool down

Extra! Extra! Giants Through Our Time

In the Biblical story, the young Israelite shepherd boy David kills the Philistine Goliath, "whose height was six cubits and a span" (about eleven feet). For his efforts, David wins acclaim and the king's daughter. Since our ancestors began painting on cave walls, tales have been told of mere men conquering giants, from cave bears, Grendel, and Moby Dick to the trophy animals of big game hunters. Unfortunately, mere men have been all too successful. Many giants, such as the elephant birds and Steller's sea cows, are already gone. Most of the rest exist in perilously small numbers in a world grown too small for them. It may not be too late to save some of these giants, but the giant– saving efforts will have to be as heroic as those of the giant killers of old.

KUMARI

the first elephant ever born at the National Zoo

...is the product of a zoo breeding program to help save Asian elephants from extinction. Although these giants have long been revered in Asia and remain an important component of the workforce in some areas, they now compete directly with people for space in an increasingly crowded world.

Jumbo

Products from popcorn to detergent are sold in jumbo sizes. Wide–bodied airplanes are called jumbo jets. The word "jumbo," (probably a corruption of the West African word, "onjamba," for elephant) actually entered common American usage as a result of the popularity of Jumbo, a circus elephant made famous in the 1880s by showman P. T. Barnum.

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Get Bigger and Live Longer

Within animal groups, size and longevity are closely related: the bigger an animal is, the longer it lives. Curiously, birds of a given size live more than twice as long as mammals of the same size. Some long–lived giants include:

Humpback whale: 95 years
African elephant: 60–80 years
Flying fox: 30 years
Ostrich: 40–50 years
Andean condor: 50+ years
American lobster: 50 years
Beluga sturgeon: 70 years

Big in the Water

Water, especially sea water, supports great weight very efficiently, so animals reach their greatest size in the sea. In animal groups with both terrestrial and aquatic forms, an aquatic form is often the giant of the group. Whales, for instance, are the largest of all mammals, and sea otters and giant otters are the biggest of all the mustelids (a group of mammals including badgers, minks, and weasels).

Threatened and Endangered at the National Zoo

Gorilla, Sumatran tiger, Asian elephant, African elephant, greater one-horned rhinoceros, Kodiak bear, Sarus crane, Andean condor, Komodo dragon, giant panda.

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Background for the Teacher:

TARANTULA: GIANT SPIDERS

The following information about the largest arachnids is provided for you to share with your students.

Some Basics:

1. Spiders have been on the Earth for at least 380 million years.
2. About 34,000 species have been identified by biologists, but there may be as many as 170,00 species total.
3. Spiders live nearly everywhere on land, and some even live in fresh water.
4. Can spiders hear? No one knows for sure yet! In addition to tarantulas, some spiders such as the barking and whistling spiders in Australia can make noises, and this leads scientists to suspect they can hear.
5. Spiders are able survive without eating for a month or more. A large, well-fed tarantula can go without food for as long as a year!

Hairy Habits:

1. Tarantulas bite in defense but usually only as a last resort.
2. Tarantulas may launch a hairy counterattack. Barbed hairs grow on the back of this spider's abdomen. The tarantula uses its hind legs to aim and brush these venomous barbs at the nose, lips, and eyelids of predators. Spiders in general are hairy, but only tarantulas have adapted to use their hairs for defense.

Poisonous Points:

1. Almost all spiders employ poison to immobilize their prey. Depending on the species, a spider either unfolds its fangs or jabs in a precise dose of poison from glands and paralyzes its ill-fated food.
2. Depending on the species, a spider's jaws open either up and down like a human's or sideways. The sideways movement in other spiders' jaws produces a bigger gape, allowing them to catch prey that is relatively large compared to their own size. A tarantula's jaws open up and down. They can't open their mouths as wide as some other spiders, but their larger size, and consequently larger mouth, enables them to get the food they need.

TARANTULAS: GIANT SPIDERS

4. All spiders are carnivorous and have to hunt or lay a trap for their prey. A spider uses neurotoxins, or poison that attacks the nervous system of its victim, to immobilize its prey. The toxins not only paralyze the animal but also preserve it, keeping it fresh until the spider is ready to eat it.
5. Despite their sinister reputation, tarantulas carry venom that is not automatically fatal to humans, although some spiders possess venom capable of killing rodents.

Don't Fall for Me:

For a tarantula, even a slight fall can be fatal. Its abdomen could burst or crack, which would usually kill the spider.

Can You Hear Me?

Some tarantulas, if they are threatened, will emit a hissing sound. They are actually stridulating—rubbing stiff bristles against their own bodies to make this noise—in order to scare off the attacker. The Goliath bird-eating tarantula is the loudest "hisser."

Dancing with Wolf Spiders

In Europe people call the wolf spider "tarantula" after the tarantella, a fast dance that originated in the 1600s in Italy. The bite of a wolf spider, it was thought, brought on a condition called tarantism, an uncontrollable urge to dance. The name stuck, and now real tarantulas are destined to share their name with other large hairy spiders, like the wolf spider, that are not real tarantulas.

TARANTULAS: GIANT SPIDERS

STUDENT ACTIVITY PAGE

Spider Anatomy

Objective:

To familiarize students with the position and function of the different body parts of the world's largest spider, the tarantula.

Directions:

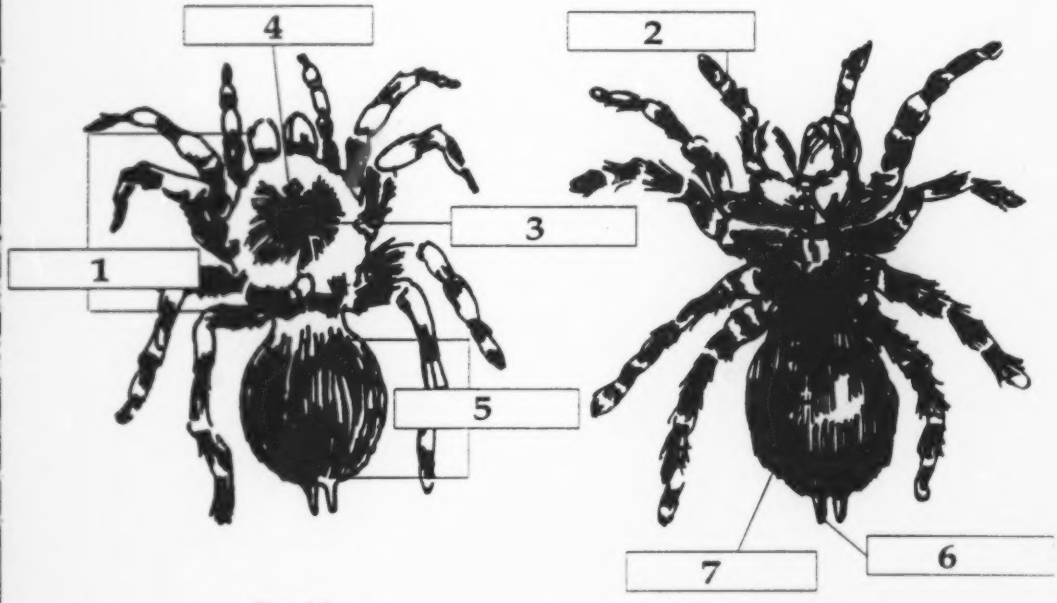
1. Read "Tarantulas: Giant Spiders" to the students and encourage them to comment on what they learn.
2. Divide students into groups of four.
3. Distribute the Spider Anatomy student activity page to each group.
4. Direct students to write the name of the appropriate body part on each label.

TARANTULAS: GIANT SPIDERS

STUDENT ACTIVITY PAGE

Read the description of each body part. Write the body number part beside the right name.

___**cephalothorax**	the head and the thorax combined
___**pedipalp**	foot feelers used to sense, smell, and taste
___**carapace**	the place at which the leg muscles are attached to the body
___**eyes**	eight tiny eyes that can see only for a few inches
___**abdomen**	the back section of the body
___**spinnerets**	used to manipulate silk as it is drawn out through microscopic tubes on the countless tips
___**lung slit**	called book lungs, a tarantula usually has two pair; the inside of the lungs are made up of a series of folds that resemble the pages of a book



Top View

Bottom View

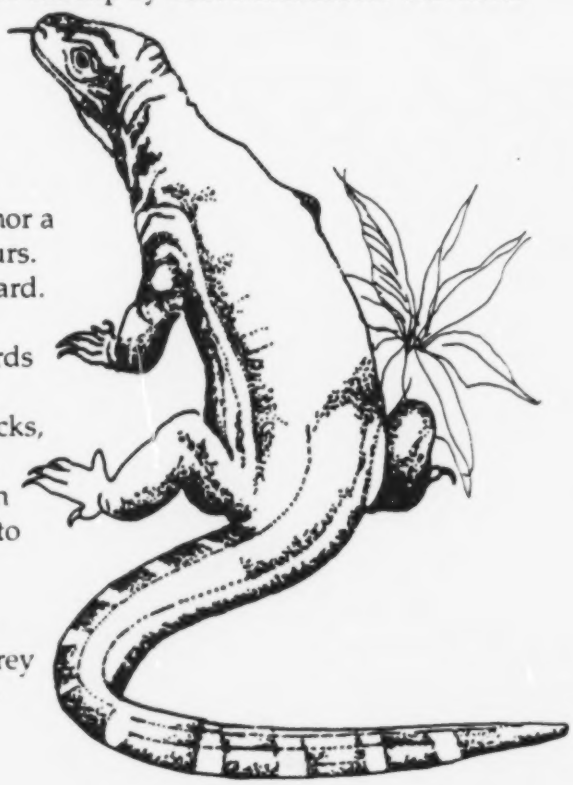
Answer Key 1 cephalothorax 2 pedipalp 3 carapace 4 eyes 5 abdomen 6 spinnets 6 lung slit

Background for the Teacher:

DRAGON EXPRESS

On the tiny island of Komodo in the Southeast Asian country of Indonesia, a nine–foot–long, 200–pound lizard lumbers through the forest, constantly flicking the ground with its light–yellow tongue. It comes into an open field and heads straight toward a carcass already being voraciously devoured by two smaller Komodo dragons. It opens its mouth, inflates its throat and threateningly pulls its large tail up behind itself. The other reptiles lower their heads and move aside as the giant lizard steps to the carcass and begins to eat.

Rumors reached European explorers in the nineteenth century from a group of volcanic islands in Southeast Asia, telling of a dangerous cannibalistic dragon inhabiting the small island of Komodo. Called "Ora" by the people of the area, these tales so intrigued explorers of the time that, in 1912, some of them decided to go to Komodo to see just what these dragons were really like. The island proved extremely difficult to reach. Powerful winds, strong currents, and perilous whirlpools made the trip by boat treacherous. Nevertheless these expeditions brought the first skins and bones of the legendary Komodo dragon to American museums.



Varanus komodoensis, the Komodo dragon, is really neither a dragon nor a relative of the long–extinct dinosaurs. It is actually the world's largest lizard. With the exception of dwarf and arboreal monitors, all monitor lizards look pretty much alike (except for their size), with long heads and necks, heavy bodies, and long thick tails. Large, wild adult male dragons can reach 9 1/2 feet and can weigh up to 250 pounds.

Komodo dragons, meat eaters like other monitor lizards, hunt their prey and also scavenge carcasses of animals that have already died.

DRAGON EXPRESS:

Objective :

To illustrate the ecology of Komodo Island and the ecological niche the Komodo dragon occupies there, students will re-create the unique environment of Komodo Island to which Komodo dragons have adapted.

Step 1: Explain to the students that they are going to design "core areas" for Komodo dragons. Distribute a copy of the map (this is an outline of the actual Komodo Island), and the Komodo basics sheet to each student. The Komodo basics sheet gives some of the most important facts about the island that have allowed the dragons to evolve to be the only land reptile in the world to dominate the food chain. Direct students to read the Komodo basics sheet and create the "core areas" (as they are described on the Komodo basics sheet under "Dragon territory") of five dragons on their maps of the island. They will need to understand the four requirements a Komodo dragon needs when it chooses such an area.

Step 2. Around the world endangered species are affected by four major issues: trade, introduction of new species, loss of habitat, and natural catastrophes. On the Endangered Species sheet the students are presented with four discussion questions that examine the environment of the island as it relates to the Komodo dragon. These hypothetical questions are designed to prompt students, using problem-solving skills, to consider how the above situations affect a species in its environment.

Step 3. Choose a habitat somewhere in the world other than Komodo Island and discuss with the students whether or not the Komodo dragon would be able to survive there. Some examples you might use include the Sahara Desert in northern Africa, the Antarctic, the Brazilian rain forests, the North American Great Plains, the Rocky Mountains, or another island habitat such as Iceland or Greenland. Keep in mind that one of the main reasons the Komodo dragon has survived is that it has never had to compete for food with a four-legged land mammal predator.

Komodo Basics

DRAGON EXPRESS:

Where in the World?

A small volcanic island only 12 miles wide and 22 miles long, Komodo is located near the equator, just a short distance from Indonesia. The island is surrounded by treacherous seas and high winds. Komodo dragons also live on Fiores and Rinca, two other Indonesian islands in the Lesser Sunda chain east of Java.

Favorite Haunts

Komodo dragons frequent the dry, open savannas of Komodo where various types of tall grass and shrubs serve as shade and hunting cover. They also lumber along dry creek beds in the forest valleys. Juvenile dragons, always a potential meal for their elders, live up in the trees, out of the reach of the adults. A young Komodo's light weight, dexterity, and slenderness suit it well for life in this environment.

Dragon Territory

Each adult dragon establishes a territory, or "core area", that has burrows in which the lizard can find shelter, thermoregulatory sites where it can warm or cool itself, ambushing spots from which it can snatch prey, and high ground from which it can survey the surroundings (either by sound or by sight). Despite its solitary nature, an adult dragon may establish a core area that overlaps with the territories of other dragons. This depends on the size and sex of the dragons, feeding conditions, and the time of year. Usually fewer than a dozen dragons will live within one mile of each other.

Dragon Diet

Komodo dragons are opportunistic feeders, meaning that they will hunt prey or scavenge carrion depending upon opportunity, choice, and necessity. Therefore, if available, they will eat a carcass, but, if not, they will prey on live animals—namely deer, buffalo, goats, and pigs. They will also eat boar, birds, and monkeys. Ten percent of an adult Komodo's diet consists of young Komodo dragons. Mainly eating geckos, young dragons will also dine on grasshoppers, beetles, and other insects.

DRAGON EXPRESS

Special adaptations

- Hinged jaw.
- Curved teeth and claws for cutting flesh.
- An excellent sense of smell.
- A digestive tract that allows a Komodo to eat almost anything; an adult dragon's digestive juices can dissolve antlers and hooves.

Ability to move easily over difficult terrain; Komodos are built low to the ground with powerful shoulders.

As a young dragon matures, its body becomes stocky and heavy. Its tail, used for balance in the trees during its youth, becomes sturdy.

Weather and Climate of Komodo Island

Komodo dragons are well suited to survive in the hot climate of Komodo and the surrounding islands, where the temperature can rise past 140 degrees Fahrenheit on the ground.

Human Population

About 600 people live in four rows of houses on the island. Built on stilts, the houses rest just off the beach.

An adult Komodo dragon establishes a core area that has:

- **burrows in which the lizard can shelter.**
- **thermoregulatory sites where it can warm or cool itself.**
- **ambushing spots for snatching prey.**
- **high ground for surveying the surroundings (either by sound or by sight).**

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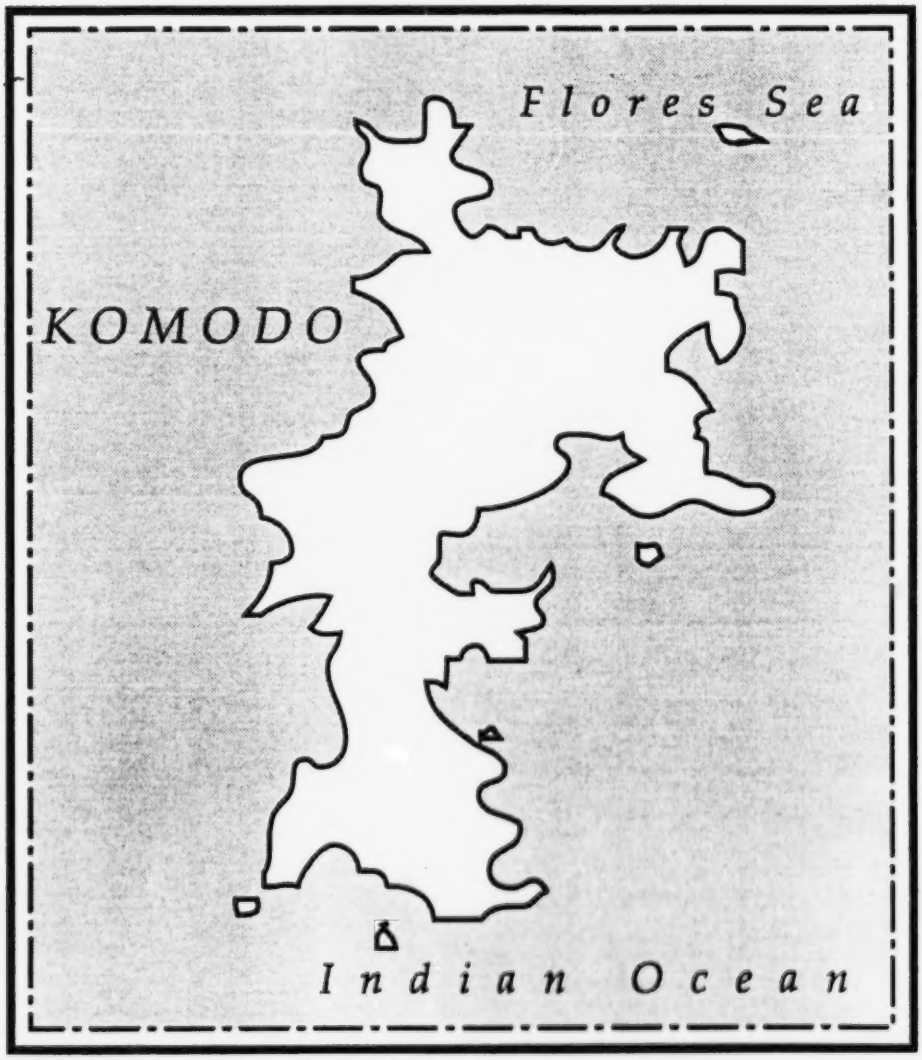
DRAGON EXPRESS

Create five core areas for five separate dragons on the map below. Mark the burrows with stars, the thermoregulatory sites with dots, the ambushing spots with x's, and the high ground with o's.



Endangered Species

DRAGON EXPRESS

What if the conditions as they exist today on Komodo were suddenly and drastically changed? Would this upset the natural balance of the island? How would this affect the Komodo dragons? Present the class with the following scenarios and ask them to brainstorm the possible outcomes. These hypothetical questions and answers are designed to encourage the students, by using problem–solving skills, to consider how these conditions affect a species in its natural environment.

1. **Trade:** The Komodo dragon's skin contains bony plates. It is undesirable for use in such products as purses, shoes, and belts. What if the dragon skin suddenly became a desirable commodity? How would this affect the Komodo dragon? (Some giants of the animal world have been affected by trade and poaching. They include rhinoceroses, tigers, and elephants.)

   Possible Outcome: Komodo dragons are recognized as a national treasure. The Komodo National Park, established in 1980, covers much of the Komodo dragon's current range. Yet, if the Komodo dragon's skin were suddenly a "hot" property, the park staff would probably find protecting the Komodo from poachers to be almost impossible. The poaching would possibly wipe out the largest of the Komodos. Once the large Komodos were gone, only the youngsters would be left. As they grew, they too would be poached. In time, the species would be dangerously close to extinction.

2. **Species Introduction:** What if a large mammalian predator such as a tiger were suddenly introduced to Komodo Island? What would happen?

   Possible Outcome: The tiger might eat well for a couple of years by hunting the island's mammalian inhabitants, but eventually it would eat a large percentage of prey animals. Prey would be so scarce that it might begin to prey on Komodo dragons. Dragons are very heavy sleepers and would pose little challenge to a hungry tiger hunting at night.

3. **Loss of Habitat:** The climate on Komodo is not conducive to farming. If the soil were more rich than arid, what affect would this have on the island? What effect would it have on the dragons?

   Possible Outcome: With more fertile soil comes the potential for farming. As greater amounts of land were converted to farming, habitat areas for the Komodo dragons would shrink. The delicate ecological balance on the island would suffer. Small dragons, without trees to live in, would have to compete with older dragons for food. They would also be in greater danger of becoming food for older dragons.

4. Natural Catastrophes: Komodo is a small volcanic island in the "Ring of Fire" cluster of volcanic islands. What would happen if there were a large volcanic eruption? What would happen to the dragons?

   Possible Outcome: With volcanic eruptions come volcanic discharges of ash, lava, soil, and rock. This could potentially poison the air, sea, and land, severely disrupting the ecological balance of the area. If the plants were poisoned, the animals that eat them would also be poisoned. If they all died, the Komodo dragons would have nothing to eat. And if the trees were to die, the young dragons would be forced to live on the ground and would quickly become prey to the hungry adults.

Follow-Up Questions

DRAGON EXPRESS

1. Is the Komodo dragon more like an iguana or a Bengal tiger? (Hint: The Komodo dragon resembles an iguana in outward appearances and, like the iguana, is also a reptile. As the top predator of the food chain with no natural enemies, a "super-predator," it resembles a Bengal tiger in its relationship to the other animals of the island.)

2. Why do isolated islands often have plant and animal life different from plant and animal life anywhere else in the world? Why are these species very often vulnerable to habitat changes?

3. How would changes in the environment of an island affect the "giant" animals, like the Komodo dragon, that live there? (Hint: Many plants and animals on islands, such as the Galapagos Islands, are not found naturally anywhere else on the Earth. Because of the island's isolation from other land masses, its life forms adapt to that specific environment. They have nowhere to go if it changes so greatly that it can't sustain them any longer.)

4. Other giants of the animal kingdom have been affected by habitat loss. In Africa, elephants knock down trees in order to get to the leaves. What happens to a forest if it is too small to feed the elephants and have trees left over? What, then, will happen to the elephants? (Hint: If they stay, they starve. If they move, they might destroy farmland or land developed by humans.)

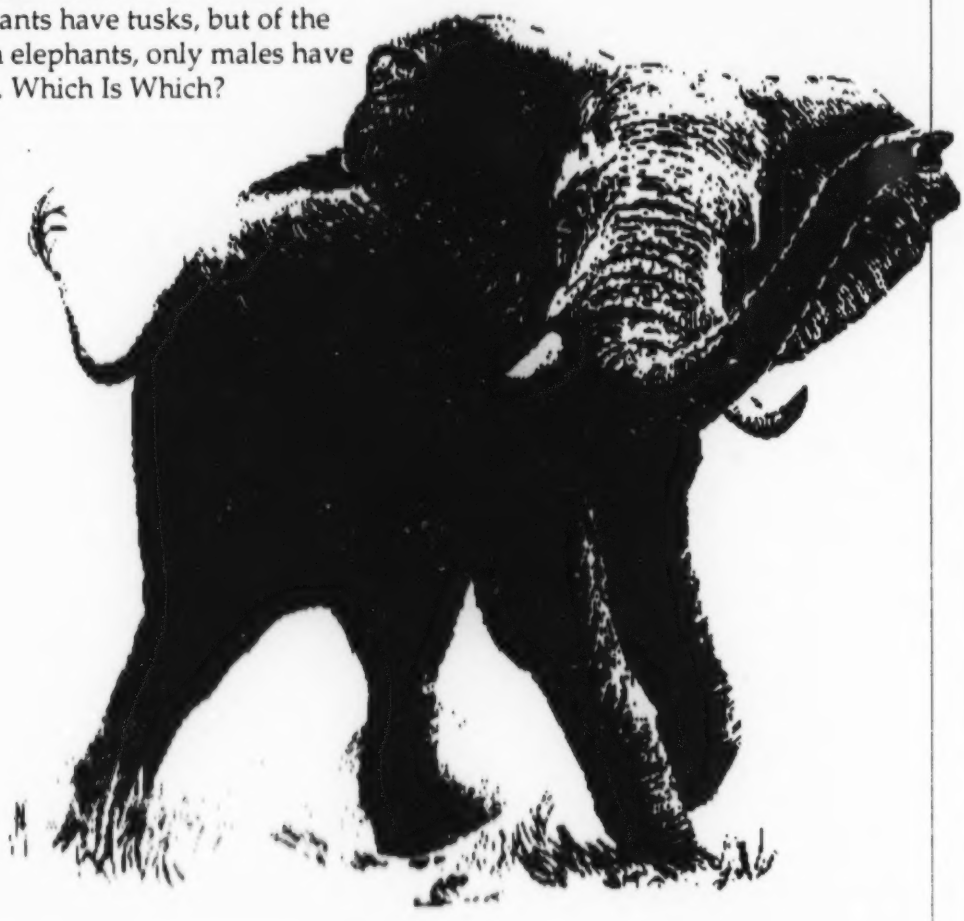
Background for the Teacher

WHICH IS WHICH?

At the Smithsonian Institution's National Zoological Park there are two species of elephant—Asian and African. The two species have very distinct features that you can pick out if you look closely at them.

The African elephant is the larger of the two species and the biggest land mammal in the world. One African elephant weighs in at an average of seven tons. A fully grown male can be up to 13 feet tall. A male Asian elephant, on the other hand, weighs around six tons and will typically stand about 11 feet tall.

Both female and male African elephants have tusks, but of the Asian elephants, only males have tusks. Which Is Which?

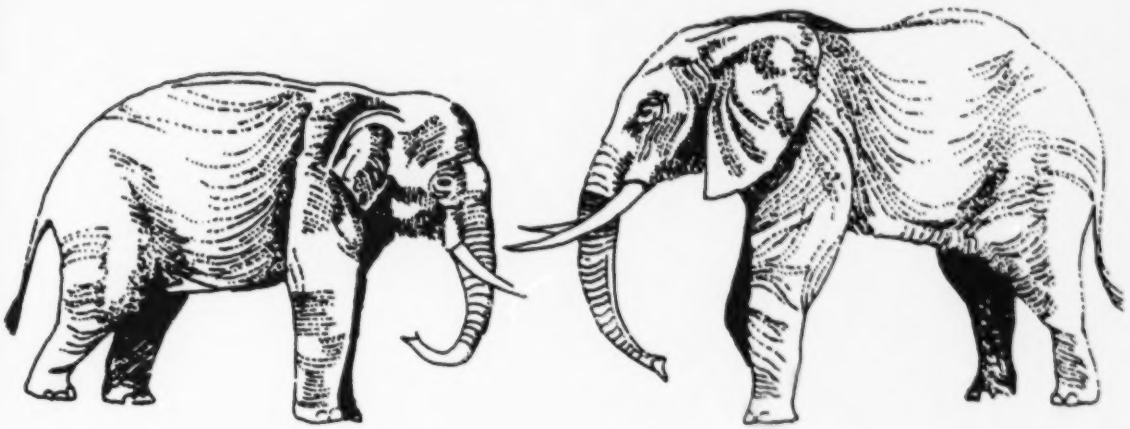


WHICH IS WHICH?

Did you know that there are two species of elephants? One lives in Africa, the other in Asia. Do you know what the differences are between the two? When you've finished this activity, you'll be able to identify Asian and African elephants when you see them on TV, in books, or at your local zoo!

Look at the descriptions below. Write the number for reach description under the correct elephant.

1. bigger of the two (about 7 tons)
2. smaller of the two (about 6 tons)
3. both sexes have tusks
4. only males have tusks
5. smaller ears
6. bigger ears
7. lives in Africa
8. comes from India
9. has one "finger" on the end of its trunk
10. has two "fingers" on the end of its trunk
11. highest point of body is at the middle of the back
12. highest point of body is at the shoulders



Answers:
African elephant
1,3,6,7,10,12

Asian elephant
2,4,5,8,9,11

Background for the Teacher

PANDA LOVERS, PONDER THIS!

How Did Pandas Get Their Markings?

This ancient legend describes why pandas have their distinctive black and white coats.

There was a time long ago in the bamboo forests of China when giant pandas were all white. One day a certain panda, while sitting contentedly and browsing on a bamboo branch, was attacked by a hungry leopard. A brave shepherdess named Losang, who was guarding her flock nearby with her three sisters, heard the terrified panda and rushed to save it.

But the four shepherdesses and the panda together were no match for the leopard. News soon spread that the lives of the panda and all four of the sheperdesses were lost in the big cat's attack.

The other pandas living high in the mountains soon discovered that one of their kin had died and that the four shepherdesses had perished trying to save him. They ambled down into the valley, crying all the while, to attend the funeral. The pandas all wore black arm bands to show their grief.

As the pandas wept they rubbed their eyes, grabbed their ears, and hugged each other. The dye from the arm bands, wetted by their tears, began to run. Soon the pandas' white coats were stained dark around their eyes and ears and in big bands across their bodies. Every panda born since that time has carried these same markings on its coat.

Background for the Teacher

PANDA LOVERS, PONDER THIS!

The giant panda is one of the most endangered animal species in the world. Only 1,000 are left in the wild. Here are some tidbits you might not have heard about the great panda that you can share with your students.

1. There are 5 million people in the world for every panda.
2. In the course of a year, pandas will mate only during two or three days in the spring. They may encounter other pandas at different times of the year but will not mate.
3. Giant pandas spend most of their time doing two things, eating and sleeping.
4. Giant pandas have lived for millions of years in China's bamboo forests. They have become uniquely adapted to feeding and reproducing in this habitat. Human disruption of the bamboo forests has put them in serious danger of extinction.
5. A panda's life revolves around bamboo. Ninety-nine percent of its diet comes from this plant.
6. Bamboo is a tough plant to chew and digest, but pandas are built to take on the job. A panda's thick, heavy skull, massive jaw muscles, and powerful teeth help it to eat bamboo as easily as you eat celery.
7. A panda has a tough esophagus and thick stomach walls to protect it from sharp bamboo splinters. But bamboo is 90 percent indigestible plant material. To get adequate nutrients from the bamboo, pandas must eat a lot of it. Because of this, they need to have access to huge areas of it in the wild.
8. Giant pandas bite off pieces of bamboo with their molars, or back teeth. Their molars are seven times as big as human molars.
9. The panda has five clawed digits and a false thumb on each front paw. This "thumb" and the base of the five digits are covered by thick pads. A panda holds bamboo by pressing it against these pads, holding it between its digits and false thumb.
10. Every 15 to 120 years, depending on the species, bamboo will flower and then die out in an area. Today, pandas live in small pockets of protected forest surrounded by areas of developed land. If the bamboo in one of these reserves dies, the pandas living there have nowhere else to go to find food and may starve to death.

Background for the Teacher

PANDA LOVERS, PONDER THIS!

11. A female panda will bear one or two clubs. Twins are common, but one usually dies. The cubs generally have a high death rate (about 50 percent in the wild). A newborn cub is very small, weighing only about the same as a stick of butter—around four ounces. Weak and fragile, it is completely dependent on its mother.
12. A female panda doesn't look pregnant, even when she is about to give birth. Her cub is so small that she doesn't gain any weight.
13. A panda cub will stay with its mother until it is about two years old. A panda reaches maturity in the wild at age five or six.
14. Pandas may look cute, but they are wild animals and therefore can be dangerous. Giant pandas will defend their territory with their long claws and sharp teeth.

THE PUZZLING PANDA

Objective: ***To encourage students to use problem-solving and observation skills to discover anatomical and genetic differences in giant pandas, bears, and raccoons; to learn how DNA provides information not visible to the human eye.***

Giant pandas and bears share features that make them seem closely related. But giant pandas and red pandas share similar features, as do red pandas and raccoons. Whew! So just what is the giant panda—a special bear, a giant raccoon, or something else?

For more than a century scientists debated this puzzling question. Scientists at the National Zoo, by combining physical and genetic evidence from DNA, put the pieces together in the late 1980s. But before you read how they figured out this puzzle, try yourself! Look at the physical evidence, make you own conclusion, and see if it agrees with the scientists' findings.

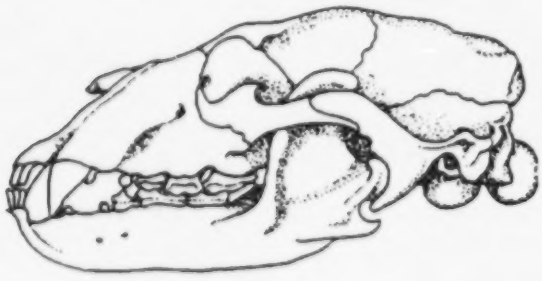
The key to the puzzle is not something you can see in the animals' physical appearances—it's in their genetic differences. Scientists from the NOAHS Center at the National Zoo used the most modern scientific methods to examine cells from the blood of giant pandas, racoons, and six kinds of bears. They compared DNA and chromosomes to see which animals were closely related. The scientists concluded that the giant panda is closely related to the bear. And the red panda turns out to be more closely related to what looks like—a racoon.

They combined evidence from the physical appearance of the animals with genetic evidence. They concluded that the modern bear and raccoon families shared a common ancestor 35–40 million years ago. The giant panda's ancestors were the same as the bear's, but the panda has been evolving from its bear cousins for about 20 million years. It is now so different from other bears that scientists suggest that it be placed within a separate group of the bear family.

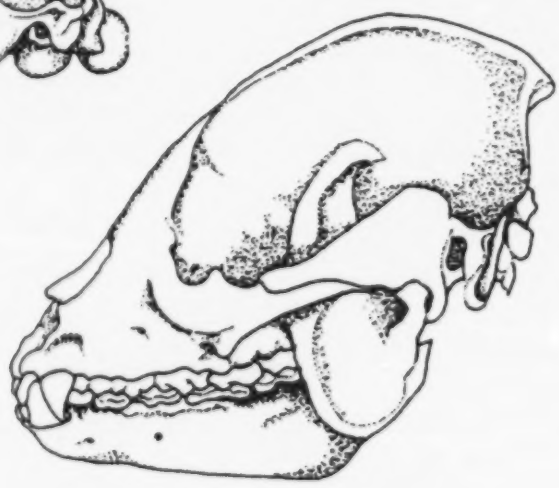
THE PUZZLING PANDA

A panda's skull is different from that of both its relatives, bears and raccoons. A panda is adapted to herbivory—eating plants. Its large cranium, or the top part of its skull, gives it extra strength in chewing tough bamboo. A panda's molars are seven times bigger than human molars.

Below are illustrations of the skulls of three mammals: a brown bear, a raccoon, and a giant panda. Look at the skulls and find things that they have in common. Now look for ways in which they are different.



Brown Bear



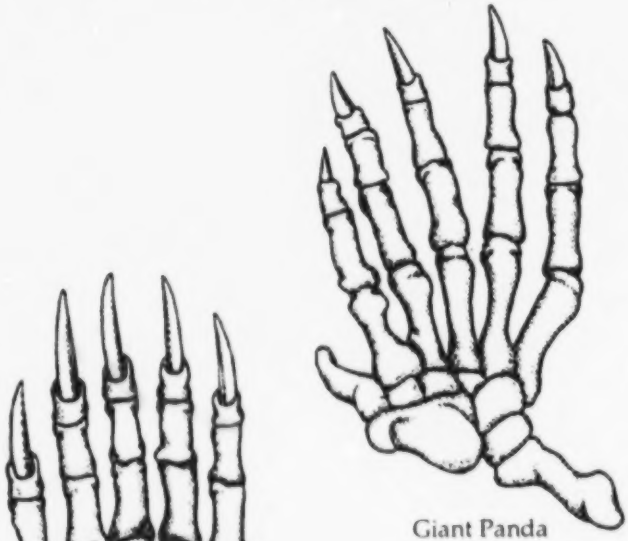
Giant Panda

Raccoon

THE PUZZLING PANDA

Pandas have a false "thumb"; it is really an extension of the wrist bone. (Humans have a true opposable thumb.) When it holds bamboo, a panda presses the shaft against the sixth "digit" of its paw. It can't wrap the false thumb around an object as humans do. Neither bears nor raccoons have false thumbs.

Below are drawings of the front paws of a brown bear, a raccoon, and a giant panda. Look at the drawings and find things they have in common. Now look for ways in which they are different.



Giant Panda

Brown Bear

Raccoon

POSTVIEWING ACTIVITIES

1. Students may research the physiology of some large animals. Two good books to use with the students are "Inside the Whale and Other Animals" by Ted Dewan (Doubleday ISBN 0–385– 30651–2) and "The Robot Zoo" by John Kelly, Dr. Philip Whitfield, and Obin (Turner Publishing, Inc. ISBN 1–57036– 064–2).

2. Students may research Carolus Linnaeus and his system for classifying plants and animals. Ask students to research the Latin names for some of the large animals that were discussed in "Land of the Giants" and classify them according to their kingdom, phylum, class, order, family, genus, and species.

3. Share several nonfiction books that focus on one particular animal. Develop a list of things that students notice that most of these books contain. Discuss the positive and negative aspects of each tradebook. Direct students to work in groups to create their own tradebooks about particular large animals. These books could be donated to students in a primary classroom after each group shares its book aloud with the class.

4. Ask students to research the ancestors of one of the large animals. They might be interested to know that the first elephant was about two feet high and did not have a trunk. Many of the animals being discussed on "Science Safari" have interesting ancestors.

5. Direct students to research an animal's needs. Direct students to design a zoo habitat for that animal based on their research. How much space is needed for one giraffe? Two giraffes? What would a zoo habitat look like and need to have in order to provide for this animal's needs? You may wish to ask students to visit a local zoo and then to discuss how the zoo designer created the habitats for each animal.

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